STAT

Dear Sir:

Transmitted herewith are nine copies of the final report on the referenced contract. We are also enclosing copies of the second and fourth monthly progress reports since we have been advised that there has been some difficulty in locating these.

The statement of work on the referenced contract calls for the delivery of a breadboard model. As the research program advanced, it was agreed by the various technical personnel concerned that the research goals could best be accomplished by not building a complete and physically identifiable piece of hardware that could be called a "breadboard focus detection system."

Accordingly, a laboratory configuration (made up of various optical components and laboratory equipment) was devised and found to be the most efficient means in both time and money for confirming the theoretical work performed. Therefore, it is respectfully requested that you delete the contract requirement for delivery of the breadboard model inasmuch as we are of the opinion that delivery of such a model would not be of any identifiable value.

Please do not hesitate to contact us if you have any questions or desire further information. STAT

Date: July 25, 1966

Location:

Subject: Change in Contract for Project 5884 Answering:

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The contract for Project 5884 states that a breadboard model of a focus detection system will be delivered to the sponsor. As the project work progressed, it was determined that the research goals of the project could best be achieved by not building a complete and physically identifiable piece of hardware that could be called a "breadboard focus detection system."

A laboratory arrangement of various optical components and other laboratory equipment was found to be the most efficient means, in terms of both time and money, to supplement and confirm the theoretical work. Therefore, it is requested that the contract be changed to delete the requirement for delivery of a breadboard model.

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FOURTH MONTHLY PROGRESS REPORT
FOR THE PERIOD JUNE 1 TO JULY 15, 1966

During this period research was concentrated on the study of an illuminated circular aperture in an opaque mask and its reflected image as a basic method for focus detection. Both analytical and experimental methods were employed and a detailed correlation of the results of the two methods is underway. Included in these basic studies are the following aspects:

(1) Consideration of the film surface as both a specular reflector and as a diffuse reflector--experiments show that the film acts primarily as a specular reflector from the surface of the film base, rather than as a diffuse reflector from the opaque image within the emulsion.

(2) The effects of variation of image density within the film on the magnitude of the reflected image--the image contained in the film has no significant effect on the return reflection. This was expected as a result of the experimental studies indicated in (1).

(3) Effects of off-axis location of the image-forming mask.

(4) The effects of angular deviation of the film plane from a plane that is perpendicular to the optical axis of the system.

(5) A study of how a combination of effects (3) and (4) can be utilized for mutual compensation of each other. The combination will permit design and placement of masks that can achieve a reasonable system tolerance for angular variation of the film from the normal. The actual angular variation must be experimentally determined for each specific operational film-drive mechanism employed before the dimensions of a final mask design could be determined. However, the technique studied will allow for offset portions of the mask to compensate for angular deviation of the film. This will provide a method for mask design that should permit the focus-detection system to function for the angular film deviations reasonably assumed to occur.

The analytical and experimental results obtained from the circular mask studies confirm the earlier experiment results and provide the basis for the design of a reasonable and practical automatic focus-detection and correction system for application to a rear projection film viewer. It is therefore suggested that a follow-on project should be initiated to design, engineer, and install a prototype automatic focus detection-correction system in an existing (government furnished) film projector.

The remaining period of this project will be spent in further analytical and experimental work on the basic focus-detection theory and its application and in preparation of the final report. The following is a tentative outline of the final report:

I Basic System
- A. Requirements
- B. Possible Approaches
- C. Selected System Using an External Pattern
- D. Results
- E. Discussion

II Analysis
- A. Single Defocus
  1. Basic Analysis
  2. Specular Light Loss - Point Source
  3. Disk Object - Total Light Return
  4. Total Intercepted Light
- B. Double Defocus
- C. Simultaneous Single and Double Defocus

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